REMARKS

The Examiner is thanked for his careful and very thorough Office Action. Claims 1-3 and 5-30 have been rejected.

Claims 1, 5, 13, 19, 22, and 28 are presently amended to clarify the "multi-point sampling pattern" used by the present inventions. This is supported throughout the original disclosure, as well as by the following passage:

> "According to a sample class of disclosed embodiments there is provided: A method for generating antialiased lines, comprising the actions of for each respective line, determining which of a plurality of orientation classes that line falls into; and performing subpixel sampling using one of a plurality of sampling patterns, in dependence on which of said plurality of orientation classes that line falls into."[1]

This is also support by figure 1 which explicitly shows a multi-point sample pattern. The foregoing amendments are submitted to improve clarity. These changes are respectfully asserted not to introduce new matter, and their entry is respectfully requested.

Review of the References

Some of the major technical differences between the references applied and the disclosure of the present application will now be reviewed. Of course, these points in the specification do not define the scope or interpretation of any of the claims; they are listed merely to help appreciate the importance of the claim distinctions that will be reviewed thereafter.

Millet

Millet et al. (U.S. Patent 6,791,569) (hereinafter "Millet") describes a method for computing normalized minor axis distance to an ideal line for variable-width line antialiasing. The described method preforms line primitive setup by constructing a triangle

[1] Original Application, Pg. 44, lines 3-9

from the two line vertices and a third vertex biased from a line endpoint by the line width divided by 2. Normalized barycentric coordinates are computed for this triangle, which together can be used for primitive attribute interpolation. One of the barycentric coordinates contains the normalized minor-axis distance to the ideal line, which can be used with a slope-correct coverage table to compute coverage. Millet does not appear to teach or suggest the use of multi-point sampling patterns, nor of selecting one of a plurality of sampling patterns depending on line classification (or any other factor).

Nakayama

Nakayama et al. (U.S. Patent 5,487,142) (hereinafter "Nakayama") discloses an anti-aliasing line display apparatus that includes an input device for inputting a coordinate and an attribute of an input straight line which is to be displayed, a judging device for judging a width and a slope of the input straight line, an analyzing device for decomposing the input straight line into individual pixels and setting a drawing pixel to be drawn, a distance calculating device for calculating a distance from a center of the drawing pixel set by the analyzing means to the input straight line, an occupying ratio calculating means for calculating an occupying ratio of the input straight line with respect to the drawing pixel based on the distance calculated by the distance calculating device, a frame buffer, a blending device for blending the color of the drawing pixel and a color input in the frame buffer in advance based on the occupying ratio and for writing the blended color in the frame buffer, and a display device for displaying the input straight line based on the color of the drawing pixel written in the frame memory.

Rejections under 35 U.S.C. 102(e)

Claims 1-3, 5-10, 13-17, 19, 20, 22-26, 28 and 29 are rejected under 35 U.S.C. 102(e) as being anticipated by Millet et al. (U.S. Patent 6,791,569). For the purpose of clarity, the first of the rejected claims, claim 1, is reproduced below:

> 1. (previously amended): A method for generating antialiased lines, comprising the actions of:
>
> for each respective line, determining which of a plurality of orientation classes that entire line falls into; and
>
> performing subpixel sampling using one of a plurality of multi-point sampling patterns, in dependence on which of said plurality of orientation classes that line falls into;
>
> wherein said determination is made without the use of an error term or pixel-by-pixel decisions.

Examiner has rejected each of these claims under a common argument. Examiner states that "

> *Millet et al. explicitly discloses such computations as "subarea" calculations and therefore the Office interprets such antialiasing methods Millet et al. to perform subpixel sampling. Note, the Office interprets that the barycentric triangles, made up of the barycentric coordinates (see Figures 4 and 5), are functionally equivalent to the sampling patterns of Applicant's claims since these barycentric triangles, and inherently their coordinates, are different and dependent upon the orientation of the line because one of the vertices of the triangles is the calculated endpoint which, it's coordinate location, is directly dependent upon line orientation."* [Emphasis Added]

I. Millet uses a single point sampling method and does not teach or suggest selecting one of a plurality of multi-point sampling patterns, as claimed.

Millet does not teach or suggest a multi-point sampling technique. Multi-sampling techniques use multiple sample points within a pixel to determine coverage of that pixel by a line. The number of the sample points covered by the line are then used to determine what color the line should be. The more sample points covered by the line, the more the line's color affects the color of the pixel. The fewer sample points covered by the line, the less that line's color affects the pixel color.

Millet, in contrast, uses a single-point sampling method, modified as discussed below. In typical single-point sampling, a line either covers the single sample point or it does not. This determines whether the pixel takes on the color of the line, or the background color. It is typically a binary decision.

Millet improves on the typical single-point sampling method, but still uses single-point sampling and never discusses multi-sampling, nor sampling patterns.

The present innovations, to the contrary, use multi-point sampling, and are not applicable in the single-point sampling context of Millet. Likewise, because Millet uses only single-point sampling, its teachings are not applicable to a multi-point sampling context. An anti-aliasing method can only be one or the other, i.e., it can only be single-point or multi-point. It cannot be both. The techniques that apply to one do not necessarily apply to the other.

In the examples taught in Millet, an imaginary ideal line (e.g., line 501 in Figure 5) is chosen, which has only one dimension and no thickness. A third artificial point is then chosen (e.g., point 504) which is used to draw a triangle between the imaginary line endpints and the new artificial point. Triangles are then drawn to determine pixel coverage, using a single sample point 505.

It is noted that Millet does teach determining the slope of a line (see, e.g., col. 5, lines 14-18). However, Millet neither teaches nor suggests using a slope classification to select a sampling pattern (as claimed, for example, in claim 1), and particularly does not teach or suggest selecting a multi-point sampling pattern. This is illustrated in the description of Figure 5 of Millet, found at col. 5, line 10 through col. 6, line 12. In that description, only one single sample point is used throughout, sample point 505. This is because the teaching of Millet is not compatible with using sampling patterns.

Therefore, the cited Millet reference fails to teach or suggest the claimed limitation of, "performing subpixel sampling using one of a plurality of multi-point sampling patterns, in dependence on which of said plurality of orientation classes that line falls into," as found in (for example) claim 1.

Further, Millet does not teach or suggest a plurality of sampling patterns, much less a plurality of multi-point sampling patterns. In Millet, a single sample point (e.g., point 505 in Figure 5) is used in all examples. The only discussion of where this sample point is located is

found in the contextual discussion (see generally the background of Millet). In that discussion, the sample point is chosen to be the center of the pixel.

Likewise, in Figure 4, the color of the pixel is determined with reference only to a single sample point, point 404. (See col. 4, lines 22-28.)

This is typical of single-point sampling methods, and further illustrates the difference between Millet and the presently claimed invention.

II. Millet does not select a sampling pattern based on an orientation class.

Though Millet does mention determining slope of a line (e.g., col. 5, lines 14-18), this information is not used to select a sampling pattern. Instead, this information is used in deciding where to place the artificial point 504. Point 504 is not a sample point, and is only used to draw a triangle. The triangle(s) used determines barycentric coordinates for a sample point--it is not used to determine which of a plurality of sampling patterns to use. Therefore, for this reason and for those stated above, Millet fails to teach or suggest the claimed limitation of, "...using one of a plurality of multi-point sampling patterns, in dependence on which of said plurality of orientation classes that line falls into..." as claimed in claim 1.

III. Millet does not teach or suggest a "method for generating antialiased lines ... using one of a plurality of sampling patterns," as claimed in claim 1.

Applicant respectfully disagrees with Examiner's assertion that barycentric triangles are functionally equivalent to the sampling patterns of Applicant's claims. A prior art reference anticipates the claimed invention under 35 U.S.C. § 102 only if every element of a claimed invention is identically shown in that single reference, arranged as they are in the claims. In re Bond, 910 F.2d 831, 832, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990). In the present application, Examiner is attempting to equate the barycentric triangles found in Millet with the present innovations, as claimed in claim 1, a **method for generating antialiased lines.** The method disclosed in Millet to create antialiasing lines is described as follows:

> "An example is now offered to demonstrate how antialiasing may be accomplished by applying barycentric coordinates to an ideal line. Suppose that a sample point resides at point 505. The barycentric coordinate for vertex 502 is computed to be the area of the sub-triangle having vertices 503, 504, and 505 divided by the area of the large triangle having vertices 502, 503, and 504. The barycentric coordinate for vertex 503 is computed to be the area of the sub-triangle having vertices 502, 504, and 505 divided by the area of the large triangle having vertices 502, 503, and 504. And the barycentric coordinate for vertex 504 is computed to be the area of the sub-triangle having vertices 502, 503, and 505 divided by the area of the large triangle having vertices 502, 503, and 504. However, there are three barycentric coordinates and only two endpoints. Hence, to derive comparable weighting factors for just the two endpoints, the three barycentric coordinates must be mapped to the two endpoints."[2]

The method disclosed by Millet requires the computation of sub-triangles using the method of barycentric coordinates. Millet teaches away from the present innovations that teach towards antialiasing using multiple sample points, as described above.

Further, Millet does not teach, suggest, or give any incentive to make the needed changes to reach the presently claimed invention. Millet actually teaches away from the

[2] Millet, Col. 5, ll 11-30

presently claimed invention because it teaches a barycentric method using a single sample point for calculating areas within a triangle, as opposed to using sampling patterns of multiple sample points, as claimed in the present innovations. Applicant's invention does not require the computationally intensive calculations implemented by Millet, including the selection of an artificial point (e.g., point 504). The use of a single sample point and selection of an artificial point for the drawing of triangles as described in Millet is inconsistent with the claimed invention of selecting one of a plurality of sampling patterns based on line classification, as claimed in at least some of the present innovations. Absent some teaching, suggestion, or incentive to modify Millet in this manner (which modification would not be simple and is not enabled by the teaching of Millet), the presently claimed inventions can be reached only through an improper use of hindsight using the Applicant's disclosure as a template to make the necessary changes to reach the claimed invention.

Applicant respectfully reargues the foregoing argument for each of the rejected claims 1-3, 5-10, 13-17, 19, 20, 22-26, 28 and 29.

IV. Millet does not teach or suggest a "method for antialiased rendering, comprising the actions of identifying, for at least one respective entire line, which one of a limited number of directions is most nearly parallel to said line" as claimed in claim 5.

Examiner has grouped claims 5, 19, and 28, and has rejected them under a common argument. For the purpose of clarity, claim 5 is reproduced below:

> A method for antialiased rendering, comprising the actions of:
> (a) identifying, for at least one respective entire line, which one of a limited number of directions is most nearly parallel to said line; and
> (b) performing subpixel sampling on said line with a subpixel multi-point sampling pattern which has maximal resolution approximately normal to said one direction;
> wherein said identification is made without the use of an error term or pixel-by-pixel decisions.

In the rejection of claims 5, 19, and 28, Examiner argues the following common argument:

"In reference to claims 5, 19 and 28, the Office interprets Millet et al. to inherently calculate in which direct the line is most nearly parallel to when Millet et al. discloses the slope of the line. Also, since the barycentric triangles are dependent upon the orientation of the line, the office interprets that these triangles inherently provide maximal resolution approximately normal to the orientation of the line.

Applicants respectfully submit that the Examiner has misapplied the concept of 'inherent' anticipation. Section 102 of Title 35 deals with novelty and loss of patent rights. An invention is said to be 'anticipated' when it is squarely described or disclosed in a single reference as identified from one of the categories of 35 U.S.C. § 102, commonly referred to as 'prior art'. Express anticipation occurs when the invention is expressly disclosed in the prior art, patent or publication. In some cases, however, when the claimed invention is not described in haec verba, the "doctrine of inherency" is relied on to establish anticipation. Under the principles of inherency, a claim is anticipated if a structure in the prior art necessarily functions in accordance with the limitations of a process or method claim. In re King, 801 F.2d 1324, 231 U.S.P.Q. 136 (Fed. Cir. 1986). A prior art reference that discloses all of a patent's claim limitations anticipates that claim even though the reference does not expressly disclose the "inventive concept" or desirable property the patentee discovered. Verdgaal Brothers, Inc. v. Union Oil Company of California, 814 F.2d 628, 2 U.S.P.Q.2d 1051, (Fed. Cir. 1987). It suffices that the prior art process inherently possessed that property. Id. Mere possibilities or even probabilities, however, are not enough to establish inherency. The missing claimed characteristics must be a "natural result" flowing from what is disclosed. Continental Can Co. v. Monsant Co., 948 F.2d 1264, 20 U.S.P.Q.2d 1746 (Fed. Cir. 1991). Unstated elements in a reference are inherent when they exist as a "matter of scientific fact". Constant v. Advanced Micro Devices, Inc., 848 F.2d 1560, 7 U.S.P.Q.2d 1057 (Fed. Cir.), cert. denied, 488 U.S. 892 (1988) and Hughes Aircraft Co. v. United States, 8 U.S.P.Q.2d 1580 (Ct. Cl. 1988). Otherwise, the invention is not inherently anticipated.

In the present case, the Examiner's assertion that the claimed elements are present in the cited reference can be made only through the use of the Applicant's disclosure as a template to fill in the missing elements. Applicant respectfully submits that the arguments under Section I and Section II are responsive to all 102 rejections, reargues each of the

arguments to each rejection under 102, and believes that all objections under 102 have been overcome.

Rejections under 35 U.S.C. 103(a)

V. The use of four sampling points is inhibited by the use of a barycentric coordinate system as described by Millet.

Examiner has rejected claims 11, 12, 18, 21,27 and 30 under 35 U. S.C. 103(a) as being unpatentable over Millet et al. (U.S. Patent 6,791,569). For the purpose of clarity, the first of these claims, claim 11, is reproduced below.

> The method of claim 1, wherein said sampling patterns have four sub-pixel sampling points.

All of the rejected claims under 35 USC 103(a) are dependant claims upon the previously argued claims. Therefore, Applicant respectfully reargues the previous arguments. Examiner makes the following argument with regard to his 103(a) rejections:

> *"In reference to claims 11, 12, 18, 21, 27 and 30, Millet et al. discloses all of the claim limitations as applied to claims 1, 5, 13, 19, 22 and 28 respectively above... At the time the invention was made, it would have been obvious to one of ordinary skill in the art to implement additional sampling points with the methods of Millet et al. in order to increase the resolution of coverage for entire line. Applicant has not disclosed that utilizing specifically four sampling points provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with the sampling techniques of Millet al. because the exact number of sampling points used in antialiasing is seen as a matter of design choice as preferred by the design and to which best suits the application at hand... Therefore, it would have been obvious to one of ordinary skill in this art to modify Millet et al. to obtain the invention as specified in claims 11, 12, 18, 21, 27 and 30."*

With reference to at least claim 11, Applicants respectfully disagree that the choice of the number of sampling points is merely a design choice. In the teaching of Millet, the single described sample point 505 is described in the context of determining the "color" for that sample point, i.e., the color for the pixel which that sample point samples. It is illogical to determine colors for multiple sample points within a single pixel, since finally the pixel can only have one color. When multiple sample points are used (and it is reiterated that multiple sample points are not used for a single pixel in Millet), they are used to determine a

final single color for a single pixel. Examiner's assertion that multiple sample points could be substituted for the use of a single sample point is inconsistent with the teaching of Millet. Were Millet modified to use multiple sample points per pixel, then its processing requirements would also be multiplied by that number of points since it determines a final pixel color for its sample point (e.g., sample point 505) (See, for example, col. 5, lines 56-57; col. col. 5, lines 64-66; col. 6, lines 6-12). These multiple colors would then have to be somehow combined to generate a final color for the pixel. No such process is taught, suggested, or enabled by Millet.

Further, it is reiterated that, because Millet only uses a single sample point, there is no teaching or suggestion in Millet of selecting one of a plurality of multi-point sampling patterns. The only sampling that is done in Millet is a single point sample, and that sample is described (as mentioned above) as being at the center of the pixel, which is consistent with typical single-point sampling for anitaliasing. Applicant finds no teaching or suggestion in Millet of a plurality of sampling patterns, nor the selection of one of a plurality of sampling patterns, nor of the selection of one of a plurality of sampling patterns in dependence on some other factor, such as line classification. If Applicant has overlooked a relevant teaching, it is respectfully requested that such teaching be pointed out with particularity.

Conclusion

Thus, all grounds of rejection and/or objection are traversed or accommodated, and favorable reconsideration and allowance are respectfully requested. The Examiner is requested to telephone the undersigned attorney or Robert O. Groover for an interview to resolve any remaining issues.

14 October 2005

Respectfully submitted,

Patrick C. R. Holmes, Reg. 46,380
Attorney for Applicant

Customer Number 29106
Groover & Holmes
One Galleria Tower, Suite 1370
13355 Noel Road
Dallas TX 75240
972-980-5840, fax -5841